ELIN COMMS

EurothermSuite, T800, T940, T3500

User Guide

invensys
EUROTHERM

© 2005 Eurotherm Limited

All rights are strictly reserved. No part of this document may be reproduced, modified, or transmitted in any form by any means, nor may it be stored in a retrieval system other than for the purpose to act as an aid in operating the equipment to which the document relates, without the prior written permission of Eurotherm limited.

Eurotherm Limited pursues a policy of continuous development and product improvement. The specifications in this document may therefore be changed without notice. The information in this document is given in good faith, but is intended for guidance only. Eurotherm Limited will accept no responsibility for any losses arising from errors in this document.

ELIN User guide

List of Contents

Section **Page**

1. OVERVIEW 3
1.1 COMPATIBILITY 3
2 CABLING 3
3. LIN NODE NUMBERS 4
3.1 LIN NODE NUMBER MAPPING 4
3.1.1 Allocation of Own IP Address and Port Number 4
ISOLATED ELIN NETWORK 4
ISOLATED ELIN NETWORK WITH DEFINED ADDRESSING SCHEME 5
NON-ISOLATED ELIN NETWORK 5
3.1.2 Mapping LIN node numbers to IP address and Port number 6
4 PROTOCOL NAMES 7
5 CROSS-SUBNET WORKING 8
5.1 FIREWALL CONFIGURATION 8
6. DIAGNOSTIC BLOCK TYPES 9
6.1 ELINDIAG BLOCK TYPE 9
6.2 EMAPDIAG BLOCK TYPE 11
6.3 PRPDIAG BLOCK TYPE 12
6.4 ELIN ADVANCED CONFIGURATION 13
APPENDIX A: INSTRUMENT-SPECIFIC INFORMATION 14
A1 PROCESS SUPERVISOR 14
A1.1 ELIN CONNECTORS 14
A1.2 TERMINAL CONFIGURATOR WITH ELIN 15
A1.3 ELIN SETUP PAGE 16
A1.4 ALIN / ELIN LEDS 17
A2 VISUAL SUPERVISOR 18
A2.1 COMPATIBILITY 18
A2.2 ELIN CONNECTORS 18
A2.3 COMMS CONFIGURATION 19
APPENDIX B: PC CONFIGURATION 21
B1 LOCAL IP SETUP 21
B2 ELIN SETUP 22
B3 MULTI HOMED HOSTS 22
B4 REMOTE SUBNET NODE LIST 22
B5 THE NETWORK INTERFACE 23
B6 LINDEVICE_N SECTION 23
B7 THE NETWORK.UNH FILE 23
B8 EUROPRP.EXE 24

Cont...

List of Contents (Continued)

Section **Page**

APPENDIX C: IP ADDRESSING 25
C1 IP ADDRESSING 25
C1.1 IP SUBNETS 25
C1.2 IP SUBNETS / CROSS SUBNET WORKING 25
C1.3 CLASS-BASED ADDRESSING 25
APPENDIX D: IP ADDRESS ALLOCATION METHODS 26
D1 MANUAL IP ADDRESS CONFIGURATION 26
D2 DHCP 26
D3 LINK-LOCAL 26
APPENDIX E: NETWORK.UNH FILE 27
APPENDIX F: GLOSSARY 28
INDEX 29

ELIN USER GUIDE

1. OVERVIEW

This document describes the differences between using ELIN and ALIN. For many users this will be limited to slight differences concerning cabling and connectors. For more ambitious users wishing to operate ELIN over wide area networks, some knowledge of IP networks is required, as is some additional configuration.

> Note: The term 'Process Supervisor' is used to describe models T940 and T940X. The term Visual Supervisor is used to describe the Model T800.

1.1 COMPATIBILITY

ELIN is supported by Process Supervisor version V3.1 or higher, Visual Supervisor version V5.0 or higher, and by EurothermSuite Versions V1.7.3 onwards. Patches are available for previous versions of EurothermSuite.

Appendix A gives information on how to configure Process Supervisors and Visual Supervisors.
Appendix B gives information on how to configure a PC.

2 CABLING

ELIN cabling to Eurotherm instruments uses standard Ethernet Category 5 ("CAT5") cable fitted with RJ45 plug connectors. Such cables are now considered to be the standard computer network cable and hence are readily available, in various lengths, from a large number of suppliers.

Each ELIN instrument is provided with an RJ45 socket for ELIN connection. The User Guide, or Handbook supplied with the instrument (either as a printed manual or as a pdf file on CD) gives wiring details.

Host PCs need to be fitted with a standard Ethernet card providing an RJ45 Ethernet connector.

Network cabling for ELIN uses "star" topology (figure 2). I.E. Each ELIN-connected LIN Node has a separate cable back to a hub. Terminators are not required for ELIN.

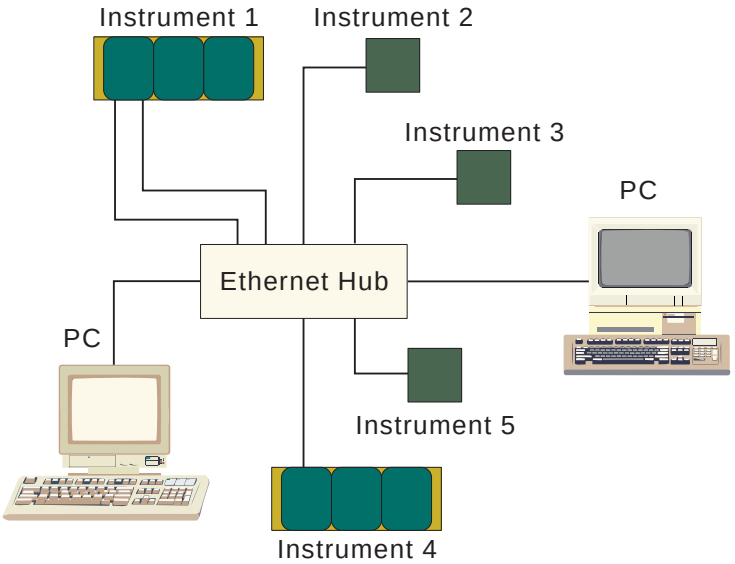


Figure 2 Star topology example.

3. LIN NODE NUMBERS

A LIN Node is uniquely identified by its 8-bit LIN Node Number (usually expressed as a 2-digit hexadecimal number). On most instruments, Node Number is set via 'DIP' switches. On the Visual supervisor the addresses are set from the operator interface (as described in section A2.3). Refer to the User Guide or Handbook supplied with the instrument for full details.

3.1 LIN NODE NUMBER MAPPING

ELIN continues to use the same method of LIN Node Numbers to identify LIN Nodes. However ELIN runs over Ethernet using IP (Internet Protocol). IP hosts are identified by an "IP address". The LIN protocol is a service accessed through a single port at a given IP address. See Appendix C for a description of IP addressing.

On instruments there is a one-to-one mapping of LIN Node Number to "IP address plus Port Number". A single PC may support multiple LIN Node Numbers at the same IP address, with each LIN Node Number assigned to a different Port Number at the same IP address. In either case a single "LIN Node Number" always maps to a single unique combination of "IP address + Port No".

In order to support ELIN, each ELIN Node has two additional functions over and above previous versions of LIN:

1. Allocation of its own IP address and Port No;
2. The mapping of other LIN Node Numbers to IP address and Port No.

3.1.1 Allocation of Own IP Address and Port Number

ELIN always allocates Port Numbers automatically. By default, all instruments use Port Number 49152, whereas PCs allocate the "next available" Port Number. In either case, no user interaction is required to allocate the Port Number.

An IP host (PC or instrument) will need to be allocated an IP address – this can be allocated either automatically or manually. The chosen method and the values of IP address allocated, depends on any existing (or planned) network topology at the site. In its simplest form, no user configuration is required. See Appendix D for a discussion of IP address allocation methods (manual, DHCP and Link-Local).

ISOLATED ELIN NETWORK

This is the simplest form of ELIN network. It consists of a number of LIN Nodes (IP hosts) which are connected together via a local area network, with which no other IP networks are to inter-operate, and over which only ELIN traffic is to be passed.

In such a system, the minimum amount of configuration is required. The PCs are set to "Obtain an IP address automatically" (this is the default). ELIN instruments have the same default.

Caution

If the IP configuration is part of a company network, do NOT CHANGE the configuration without consulting the relevant IT manager.

PCs and some instruments initially attempt to obtain their IP address settings via DHCP or BootP. When this fails (there being no DHCP server present) they default to using Link-Local to obtain their IP addresses. Link-Local involves a level of negotiation between the various IP hosts to ensure they all end up with unique IP addresses. IP addresses assigned by Link-Local are always in the range 169.254.X.Y.

LIN NODE NUMBER MAPPING (Cont.)

ISOLATED ELIN NETWORK WITH DEFINED ADDRESSING SCHEME

Similar to 'Isolated ELIN Network' described above, but local IT policy requires the use of defined IP addressing schemes. It is beyond the scope of this document to discuss the reasons behind such IP addressing schemes, other than to say that the local IT department should be consulted on questions concerning the local IT policy.

Addressing schemes may be imposed either by use of a DHCP server, or by explicit settings at each IP host.

The use of a DHCP server is more common, as everything can be configured at a central point. Under these circumstances, configuration of PC and instruments is the same as that described above. I.E. default settings are used.

IP address and Subnet Mask can be set explicitly at each PC and instrument. See Appendix A for specific information for instruments. See Appendix B for specific information for PCs.

NON-ISOLATED ELIN NETWORK

A non-isolated network is a network subnet which has links to other network subnets (either within the same site/ organisation, or possibly to wide area networks which may include the public internet). Such a system must have a defined addressing scheme.

Managing a network infrastructure of this scale is not a simple job, and it is assumed that if this requirement exists, a local IT department will also exist, to manage the system.

Such addressing schemes may be imposed either by use of a DHCP server, or by explicit settings at each IP host.

IP address and Subnet Mask can be set explicitly at each PC and instrument. See Appendix A for specific information for instruments. See Appendix B for specific information for PCs.

3.1.2 Mapping LIN node numbers to IP address and Port number

All ELIN Nodes operate a Port Resolution Protocol (PRP) which handles the problem of resolving the mapping of a remote LIN Node Number to the appropriate IP address and Port Number. Operation of PRP is (for the most part) invisible. The user specifies the LIN Node Number of the remote LIN node, and PRP automatically derives the real IP address and Port Number.

The only circumstances under which PRP is not fully automatic is where a LIN Network is being constructed from a collection of LIN Nodes which are located on more than one subnet.

PRP cannot automatically locate LIN Nodes on “other subnets” because “other subnets” could literally include the entire world. However, once one LIN Node has learnt about one other LIN Node on another subnet, it shares that information with all other LIN Nodes on the local subnet. The effect of this is that all LIN Nodes on all subnets ‘learn’ about all other LIN Nodes on the complete LIN Network. This requires minimal configuration.

The rule for configuration of “cross subnet” working is as follows: “At least one LIN Node on each subnet must be configured with the IP address of at least one LIN Node on each of the other subnets which make up the entire LIN Network”. See figure 3.1.2 and subsequent text, for an example

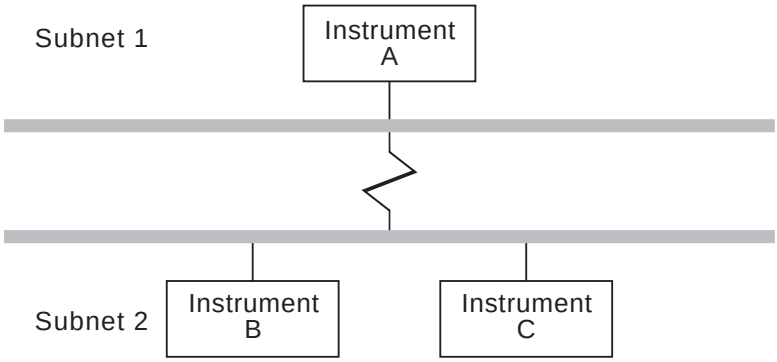


Figure 3.1.2 Cross subnet example

In this example there is a single instrument (“A”) on subnet 1, and two instruments (“B” and “C”) on subnet 2.

If A is configured with the IP address of B, then B learns about A when A tries to talk to B. Once B has learnt about A it shares this information with C.

C then tries to talk to A, which then learns about C.

All LIN Nodes now know about all other LIN Nodes on the LIN Network, even though only LIN Node A had any specific “cross subnet configuration”.

4 PROTOCOL NAMES

LIN supports a maximum of 254 valid Node Numbers (Hex 01 to Hex FE). Large systems may need to exceed this by using multiple logical LIN networks coexisting on the same physical network. This can be achieved by using Named LIN Networks (see figure 4 for a simple example).

By default, all instruments form part of the “NET” network, but this default name can be overridden in the network.unh file. This ‘named LIN network’ must be included in the [LIN] section of the “network.unh” file. See Appendix E for details of the network.unh file. See Appendix A for instrument-specific information, and Appendix B for PC-specific information.

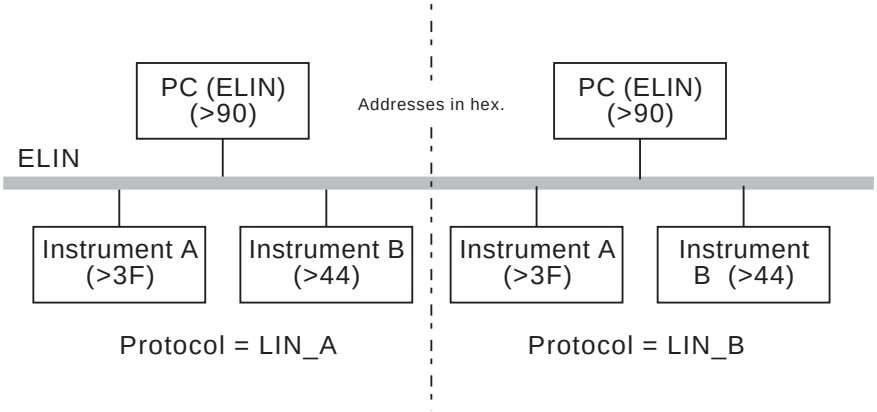


Figure 4 Named LIN networks example

5 CROSS-SUBNET WORKING

By default, all ELIN LIN Nodes disable the ability to communicate cross-subnet. This is a security feature designed to prevent unauthorised access over wide area networks. In order to enable cross-subnet working it is necessary to enable the “AllSubnet” feature through the network.unh file. It is also possible for the Process Supervisor to enable and disable cross-subnet working dynamically, at runtime. See Appendix A for configuration details . See Appendix B for PC configuration.

When cross-subnet working is enabled, the necessary security features should be put in place to prevent unauthorised access. It is the responsibility of the company installing the instrument to ensure that a Firewall or other protective device is in place to prevent unauthorized access.

5.1 FIREWALL CONFIGURATION

The following information is provided to assist IT personnel with firewall configuration:

1. PRP uses UDP port 1264
2. ELIN uses UDP.
3. ELIN instruments always use port 49152.
4. ELIN on PCs uses dynamically allocated ports.
5. ELIN systems require both PRP and ELIN to pass through firewalls in order to function correctly.
6. ELIN and PRP can cope with NAT, but they expect a consistent configuration. For example, if an IP address from another subnet is NATed to appear as if it is on a local subnet, ELIN and PRP expect broadcasts to reach that IP address (this requires the NAT router to generate pseudo-broadcasts to ensure the packets reach the destination).
7. ELIN expects all LIN nodes on a logical LIN network to be reachable from all other nodes. For example, if there are two LIN nodes inside a firewall, and two LIN nodes outside a firewall, all forming part of the same logical LIN network, then it is essential that both LIN nodes outside the firewall are allowed to communicate with both LIN nodes inside the firewall (and vice versa). Allowing only partial connectivity causes significant problems, particularly for the LIN Network Explorer utility.

   Common practice is to allow hosts inside the firewall to initiate access to the outside; but not vice versa. If such a policy is adopted then it is necessary to configure at least one of the ELIN nodes inside the firewall with the IP addresses of all ELIN nodes outside the firewall. This must be done to ensure the correct operation of remote cross-subnet learning of mapping (see section 3.1.2).

6. DIAGNOSTIC BLOCK TYPES

In order to assist in the debugging and fault finding of ELIN systems, diagnostic blocks have been added to the LIN Database.

6.1 ELINDIAG BLOCK TYPE

```
OVERVIEW   Block: elind_54   Type: ELINDIAG              Compound:
-------------------------------------------------------------------------
                                      |
 LLCport   0                          | Alarms
 MACport   0                          |
 MACtype   ELIN                       | txCount    627
 MACstate  Online                     | txTimeOut  0
 Procesor  Primary                    | txReject   0
 lastErr   0                          | txImmRsp   314
                                      | noImmRsp   0
 ThisNode  >0554                      |
 ThisIP    149.121.165.188            | rxCount    627
 ThisPort  49152                      | rxReq      314
                                      | rxRspOk    275
 RemEntry  0                          | rxUnknwn   0
 RemNode   >0112                      | rxRspErr   0
 PrimIP    149.121.165.45             | rxRspBsy   39
 PrimPort  1065                       |
 ScndIP    0.0.0.0                    | ClearCnt   FALSE
 ScndPort  0                          |
 ScWeight  32767                      | PrevNode   >0112
 NAT       FALSE                      | NextNode   >0112
 Remstate Known                       |
                                      |
```

LLCport and MACport	Normally both zero, as most LIN Nodes support only a single LIN interface.
MACtype	Should be ELIN. If an attempt is made to operate this block with a different LIN type (e.g. ALIN) then the correct LIN type will be displayed here – but the remainder of this block will not function.
MACstate	Should always show “OnLine” any other value indicates a serious internal error.
Procesor	Should always read “Primary”. ELIN is redundant processor aware – but it is not possible to view blocks running on a secondary processor.
LastErr	Should always read “0”. If MACstate is not “OnLine” it may show an error code which can help identify the reason.
ThisNode, ThisIP, ThisPort	These fields show the LIN Node Number to IP address + Port Number mapping for this LIN Node.
RemEntry	This field shows the index number into a table of remote LIN Node Number mappings. As entries are added and removed from the table, so individual entries can change their index. Setting this field to “-1” allows you to enter the required remote node number into the RemNode field (although the ScWeight field does not work in this mode). NOTE: ELIN only maintains mappings of nodes it actually wishes to talk to - do not expect to find a mapping entry for a node if there is no LIN traffic between that node and this node.
PrimIP, PrimPort	These show the IP address and Port Number mapping for the Primary processor at the LIN Node Number shown in RemNode.
ScndIP, ScndPort	The IP address and Port Number mapping for the Secondary processor at the LIN Node Number shown in RemNode. If this LIN Node Number is not a redundant pair, then these fields are “0”.

(Continued)

6.1 ELINDIAG BLOCK TYPE (Cont.)

ScWeight	Shows the “weight” of the Secondary processor at the LIN Node Number shown in RemNode. A “weight” of 2 indicates a physical secondary processor. A “weight” of 1 indicates a secondary network interface on the primary processor. A “weight” of 3 indicates a secondary network interface on the secondary processor.
NAT	If TRUE this indicates that the given IP address and Port Number mapping has been subject to NAT (“Network Address Translation”). This means that the real IP address and Port Number of the remote node are different to that displayed, but that these values have been “translated” enroute by a NAT-router.
Remstate	This indicates the quality of the mapping. The values “unresolved” and “known” have obvious meanings. If you see the value “assumed” – this means that traffic has been received from the specified node using the specified IP address and Port Number, but that the mapping has not been confirmed by PRP. LIN communications can successfully take place using an assumed mapping – but this is normally only a transitory state.
TxCount	A count of attempted packet transmissions
TxTimOut, txReject	Unused
TxImmRsp	A count of “immediate responses” sent to acknowledge received packets.
NoImmRsp	A count of attempted packet transmissions for which no immediate response was received.
RxCount	A count of received packets
RxReq	A count of received packets which were valid request packets
RxRspOk	A count of received request packets to which an “OK” response was sent
RxUnknown	Unused
RxRspErr	A count of received packets which cannot be correctly identified
RxRspBsy	A count of received request packets to which a “busy” response was sent.
ClearCnt	This field should be set TRUE, in order to zero all the “count” fields.
PrevNode, NextNode	Gives the LIN Node Number of the numerically next lower and higher LIN Nodes Numbers on this network. (Note these values “wrap round” through Hex 00 and Hex FF).

6.2 EMAPDIAG BLOCK TYPE

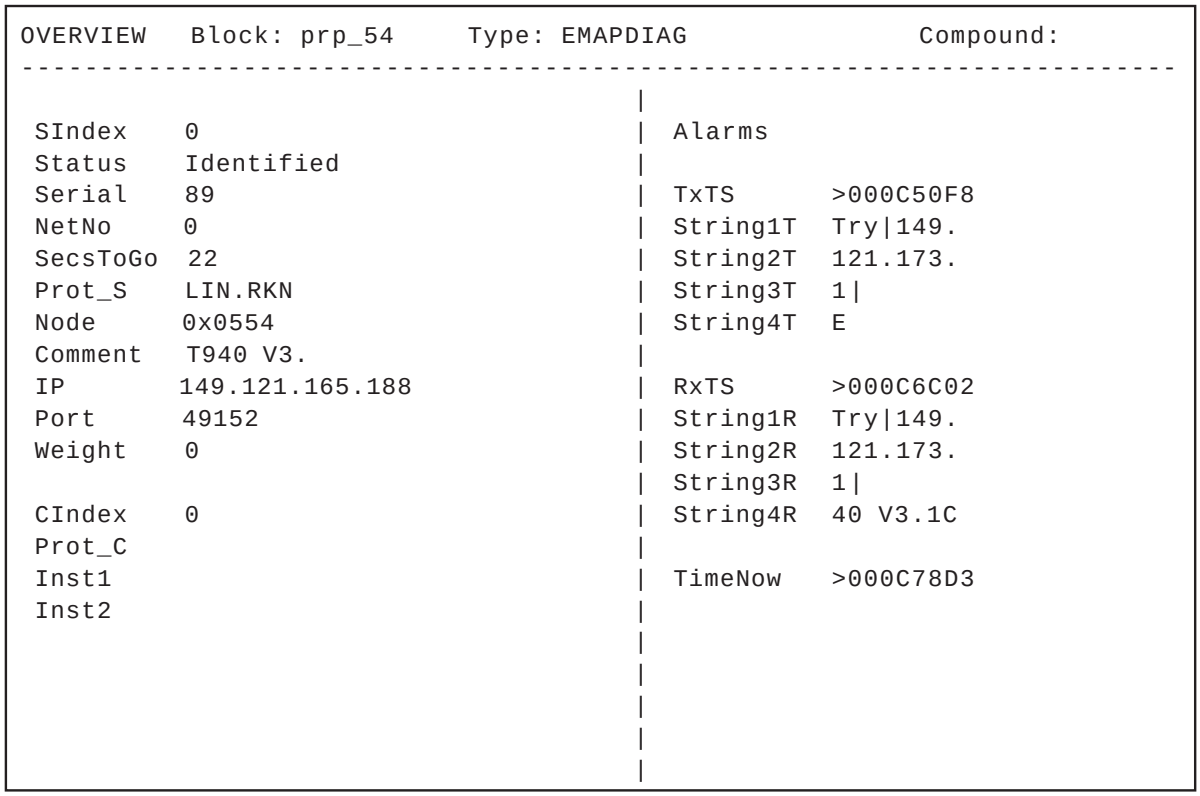
```
OVERVIEW   Block: emapd_54   Type: EMAPDIAG              Compound:
-------------------------------------------------------------------------
                                          |
 Seg0_map  >0000                          |  Alarms
 Seg1_map  >0004                          |
 Seg2_map  >0000                          |  NodeStat  >12
 Seg3_map  >0000                          |
 Seg4_map  >0000                          |  NodePrev  >54
 Seg5_map  >0010                          |  NodeNext  >54
 Seg6_map  >0000                          |
 Seg7_map  >0000                          |  TimeNow   >D78D
 Seg8_map  >0000                          |  LastI_Am  >D788
 Seg9_map  >0000                          |
 SegA_map  >0000                          |
 SegB_map  >0000                          |
 SegC_map  >0000                          |
 SegD_map  >0000                          |
 SegE_map  >0000                          |
 SegF_map  >0000                          |
                                          |
 ThisNode  >54                            |
 PrevNode  >12                            |
 NextNode  >12                            |
                                          |
```

This block shows a complete map of all LIN Nodes on this LIN Network – regardless of whether this node specifically communicates with the other nodes. The particular LIN Network in this example has only two LIN nodes on it.

In the following descriptions, the'>' character indicates that the value is in hexadecimal notation.

Seg0_map to SegF_map	Each of these is a 16-bit bitfield, where each bit represents a single LIN Node (between 0 and F) in segment 'N' of the network, where N is also between 0 and F. Thus, for SegN_map, a value of >0001 would imply node >N0 only; >0002 would imply Node >N1 only; >0003 = Nodes >N0 and >N1, and so on. As an example, for Seg3_map, the node numbers would be >30, >31 and >30 + >31, and so on. Hence the value ">0004" in the field Seg1_map corresponds to LIN Node Number >12; and the value ">0010" in the field Seg5_map corresponds to LIN Node Number >54.
ThisNode	This shows the LIN Node Number of the instrument on which the block is running.
PrevNode, NextNode	Gives the next lower and higher LIN Node numbers on this network. (Note these values 'wrap round' through Hex 00 and Hex FF).
NodeStat	In this field you can enter the Node Number of another LIN node on the network in order to monitor its presence on the network.
NodePrev, NodeNext	Gives the next lower and higher LIN Node numbers on this network, relative to the node number in NodeStat. (Note these values 'wrap round' through Hex 00 and Hex FF).
TimeNow	Gives the current system time
LastI_Am	Gives the system time at which the existence of the LIN Node Number (specified in NodeStat) was last confirmed.

6.3 PRPDIAG BLOCK TYPE



The primary purpose of this block is to expose the inner workings of the PRP. The details of PRP are beyond the scope of this document. One field, however, may be of interest:

Prot_S This string which identifies the “Protocol Name”. It always starts with the 4 characters “LIN.” The remaining characters show the configured protocol name (“NET” by default). Remember that only LIN Nodes with same Protocol Name are considered to be part of the same LIN Network.

6.4 ELIN ADVANCED CONFIGURATION

Products that support bridging between ALIN & ELIN, now support configuration of the timeouts and retries associated with ELIN.

ELIN is based on IP and was originally designed to run over high speed Ethernet. However IP can just as easily be run over slower links, in which cases, standard ELIN may start to encounter errors due to the short timeouts etc. On a T225 these timeouts are configured on the ELIN page. In NTSE they are configured in NTSE.INI in the LINOPC install directory.

Problems normally manifest themselves as communications alarms, because repeated errors force a disconnection between the end nodes. If this is the case then increasing the timeouts or retries may solve the problem.

Timeouts/retries	Interpretation	Default
Unack Timeout	Low level Timeout if no response on a local IP Subnet	100ms
Rmt Unack Timeout	Low level Timeout if no response on a remote IP Subnet	250ms
No of retries	Number of low level retries	3
Fwd No of retries	If acting as a bridge forwarding message, the number of low level retries	100
UnThrottled Tx Lim	Number of consecutive busies before applying a delay between transmits	10 (100 NTSE)
Busy Throttle Time	Delay between tranmits after “UnThrottled Tx Lim” consecutive busy’s	50 (0 NTSE)
EDB Connect Used	Timeout on a connection via a T225/NTSE if there is data being sent.	5Secs
EDB Connect Unused	Timeout on a connection via a T225/NTSE if there is no data being sent.	30Secs
EDB Timeout Used	Timeout on an external database connection via ELIN if there is data being sent.	5 secs
EDB Timeout Unused	Timeout on an external database connection via ELIN if there is no data being sent.	30 secs

APPENDIX A: INSTRUMENT-SPECIFIC INFORMATION

A1 PROCESS SUPERVISOR

All Process Supervisors prior to V3/1 were ALIN instruments. The hardware included an Arcnet card fitted internally to the unit to provide ALIN support.

Process Supervisor software V3/1 and later checks for the presence of an internal Arcnet card, and if one is fitted it defaults to ALIN operation. If no internal Arcnet card is fitted, the unit defaults to ELIN operation.

It is possible to override this default behaviour when an arcnet card is fitted by setting the “ELIN=on” option in the network.unh file (see Appendix E).

A1.1 ELIN CONNECTORS

As shown below, ELIN uses the System A connectors for each processor.

Note: Unlike other communications connectors, the ‘System’ connector pairs are not wired in parallel with one another.

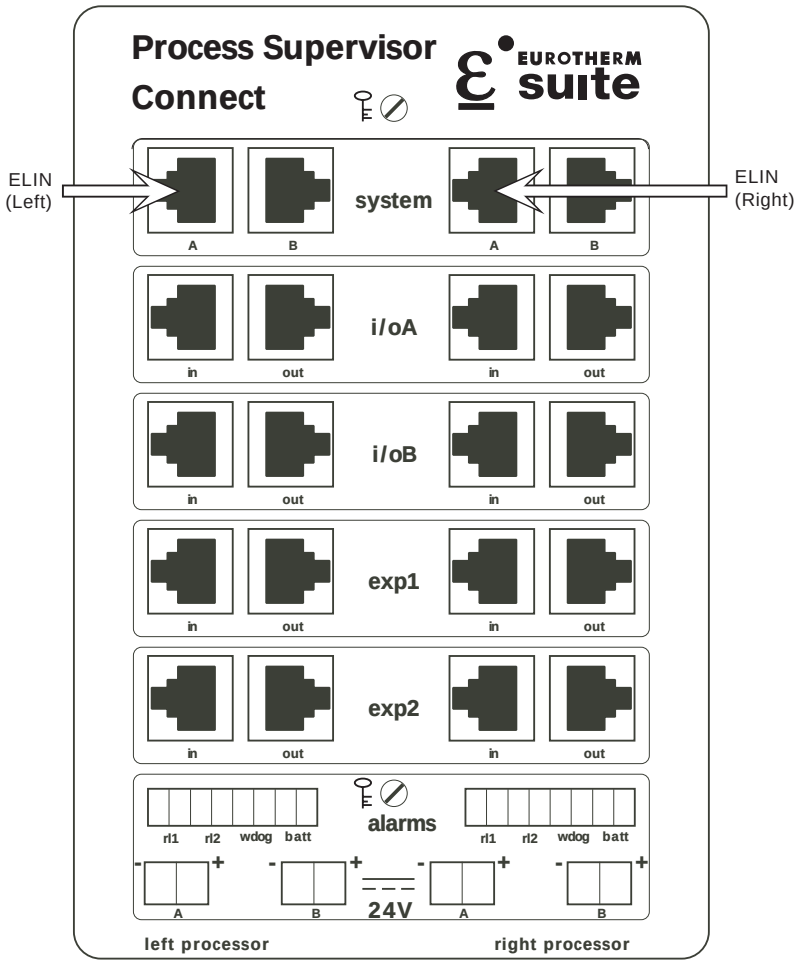


Figure A1 ELIN connector locations

A1.2 TERMINAL CONFIGURATOR WITH ELIN

The terminal configurator provides a sign-on screen which provides some important information concerning the ELIN/IP/Ethernet configuration. A typical sign-on screen might look like this:

```
EPA T940 Process Supervisor  - V3/1 Beta version - 31H at 133 MHz
(Hardware Build: 00 - 1Mbyte SRAM fitted at Hex D00000)
Profibus card: PB-COMBIC104-PB  Version: V01.058 29.05.01
Ethernet (MAC) address = 00:E0:4B:00:45:DA
IP address = 149.121.165.188
Subnet mask = 255.255.252.0
Default gateway = 149.121.164.253
POST result (0000) = SUCCESS
Hotstart failed because: Warmstart switch is disabled
Last shutdown because: Successful Power Down

1 ANSI-CRT
>>>
```

The following items refer to the ELIN/IP/Ethernet interface:

Ethernet (MAC) address	This shows the address of the Ethernet interface. This value is unique and is permanently fixed for an individual instrument.
IP address	The IP address currently assigned to this instrument. It may be configured within the instrument or derived by BootP or Link-Local.
	Note: The IP address must be entered manually for Process Supervisors.
Subnet Mask	Gives the subnet mask currently assigned to this instrument. An IP host uses the subnet mask, in conjunction with its own IP address, to determine if a remote IP address is on the same subnet (in which case it can talk directly to it), or a different subnet (in which case it must talk to it via the Default Gateway). See Appendix C for further details.
Default Gateway	The IP address of the Default Gateway. It is the address via which this instrument must talk in order to communicate with IP addresses on other subnets. If undefined (0.0.0.0) then this instrument can talk to other IP hosts only if they are on the same subnet.

A1.3 ELIN SETUP PAGE

The terminal configurator Utilities Menu now offers the additional ELIN Setup Page. This page allows an instrument's network.unh file to be configured from a user-friendly interface, rather than by direct file editing.

```
ELIN Setup (network.unh file)
--------------------------------------------------------------------------------
                                          |
 LIN PROTOCOL SETUP                       | REMOTE SUBNET NODE LIST
                                          |
  Protocol Name      RKN                  |   149.121.173.1
  All Subnet Enable  ON                   |
  Elin Only Enable   ON                   |
                                          |
                                          |
 LOCAL IP SETUP                           |
                                          |
  Get Address Method Fixed                |
  IP Address          149.121.165.45      |
  Subnet              255.255.252.0       |
  Default Gateway     149.121.128.138     |
                                          |
                                          |
                                          |
                                          |
                                          |
                                          |
                                          |
                                          |
```

LIN PROTOCOL SETUP — This section allows specification of those items in the "[LIN]" section of the network.unh file.

All Subnet Enable — By default, Process Supervisors will not communicate ELIN cross-subnet unless AllSubnet is set to 'On'. This defines the behaviour when the instrument first powers on.
The ability to communicate cross-subnet can be modified at runtime by using a new options bit in the instrument's header block "Options. AllSubnt". Set this bit TRUE to allow cross-subnet working; FALSE to prohibit cross-subnet working.

Caution

It is possible to set this bit FALSE remotely from a cross-subnet connection. If this is done communications are lost and it is not possible to reset the bit to TRUE

LOCAL IP SETUP — This section allows specification of those items in the "[IP]" section of the network.unh file. If 'Get Address Method' is specified as 'Fixed', then additional fields will be presented to allow the specification of IP address, Subnet Mask and Default Gateway, as shown above.
Process Supervisor units must use 'Fixed'.

REMOTE SUBNET NODE LIST — This section allows the specification of those items in the "[PR]" section of the network.unh file. A list of the IP addresses of remote nodes with which it is desired to communicate is entered here.

When configuration is complete, ESC is pressed. Confirmation is required in order to update the network.unh file. If 'Y' is typed (to update the file), the instrument will have to be power-cycled before the changes take effect.

A1.4 ALIN / ELIN LEDS

The health of the LIN interface is indicated by LEDs on the instrument's front panel. ALIN health is indicated by the I/O A LED; ELIN health is indicated by the System A LED.

It is thus possible to determine whether the unit is running ELIN or ALIN by observing which of the above two LEDs is illuminated .

The LEDs indicate LIN status as follows:
Green – LIN is operating correctly
Red flash – external problem (e.g. cable break)
Red steady – internal problem (e.g. Process supervisor hardware fault).

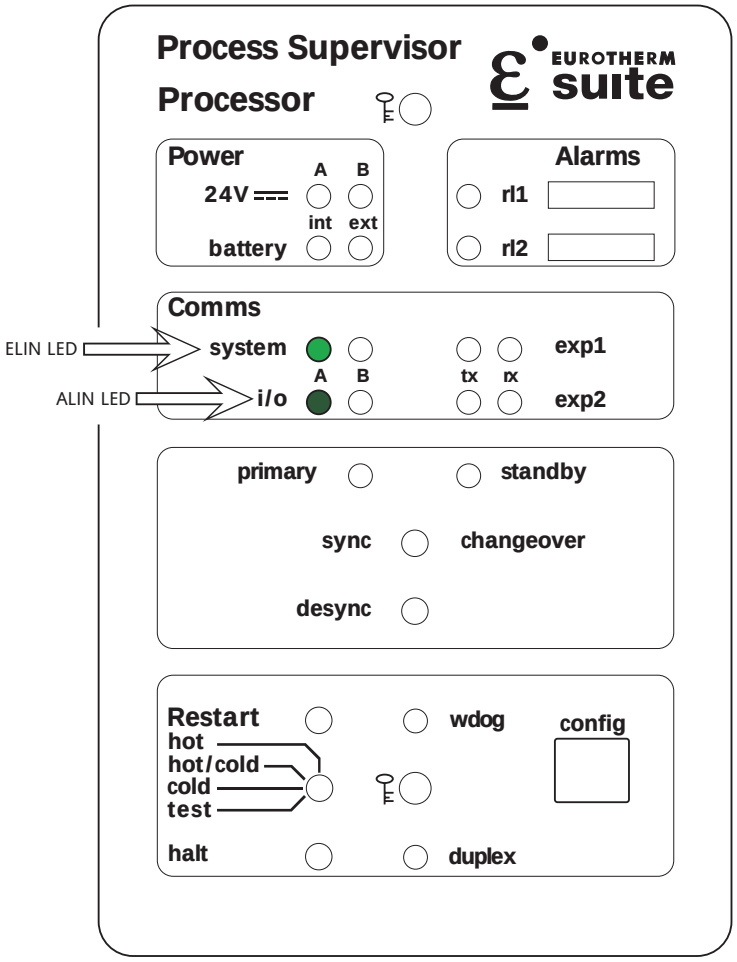


Figure A1.4 Processor module Comms LEDs

A2 VISUAL SUPERVISOR

A2.1 COMPATIBILITY

ELIN support is offered in Visual Supervisors with software levels of V5.0 upwards. Earlier versions can not be upgraded to support ELIN

A2.2 ELIN CONNECTORS

User termination is by means of an RJ45 connector located as shown (not to the same scale) in figures A2.2a and A2.2b, below.

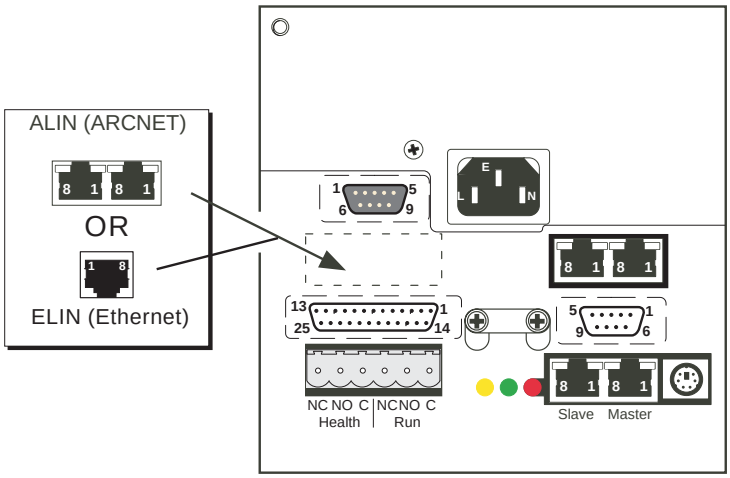


Figure A2.2a ELIN / ALIN connector location (small frame unit)

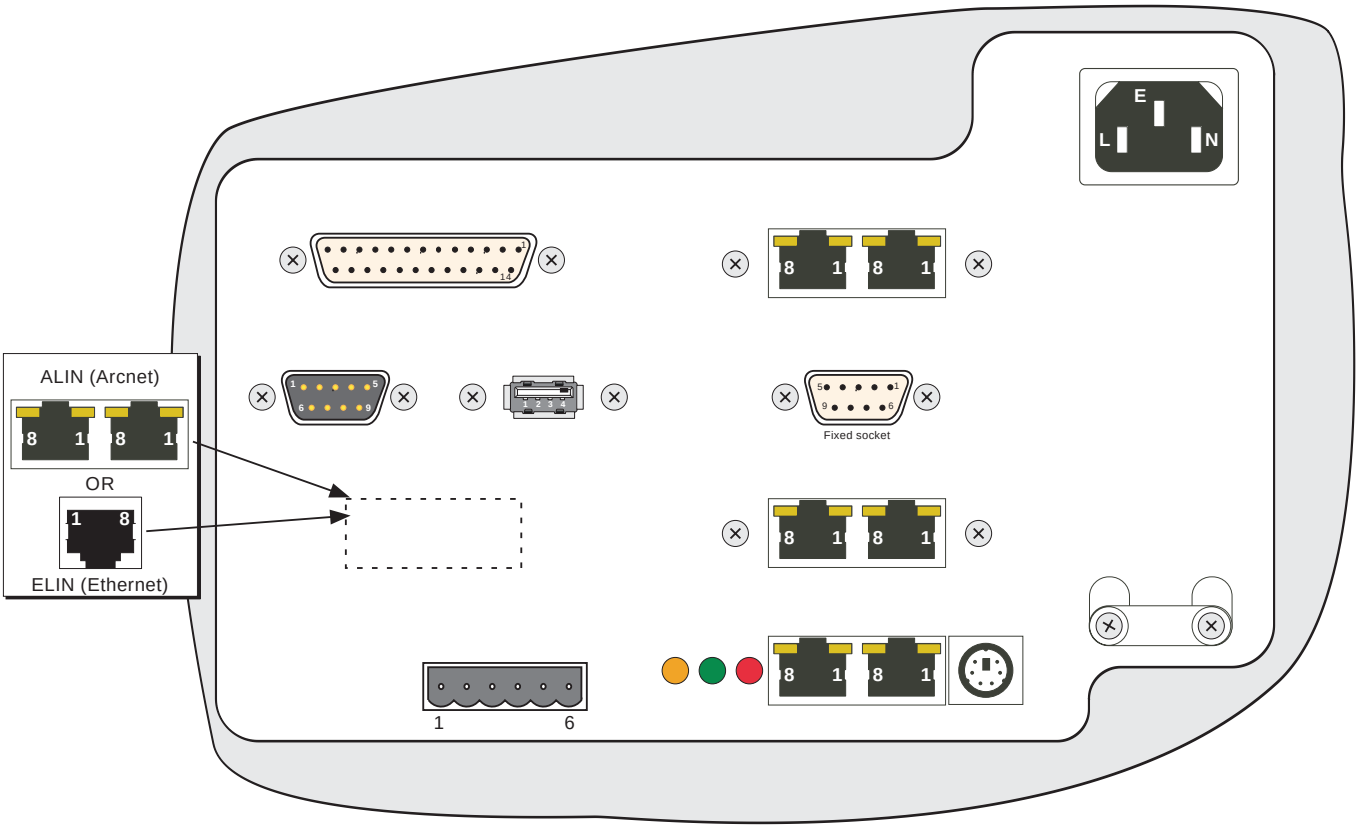


Figure A2.2b ELIN / ALIN connector location (large frame unit)

A2.3 COMMS CONFIGURATION

Configuration is carried out from the Comms Set-up page, accessed as shown in figure A2.3a, below.

Ethernet setup is accessed by operating the 'Ethernet' key at the bottom of the comms set-up page. Figure A2.3b shows the relevant fields. To return to Comms setup, operate the Comms button.

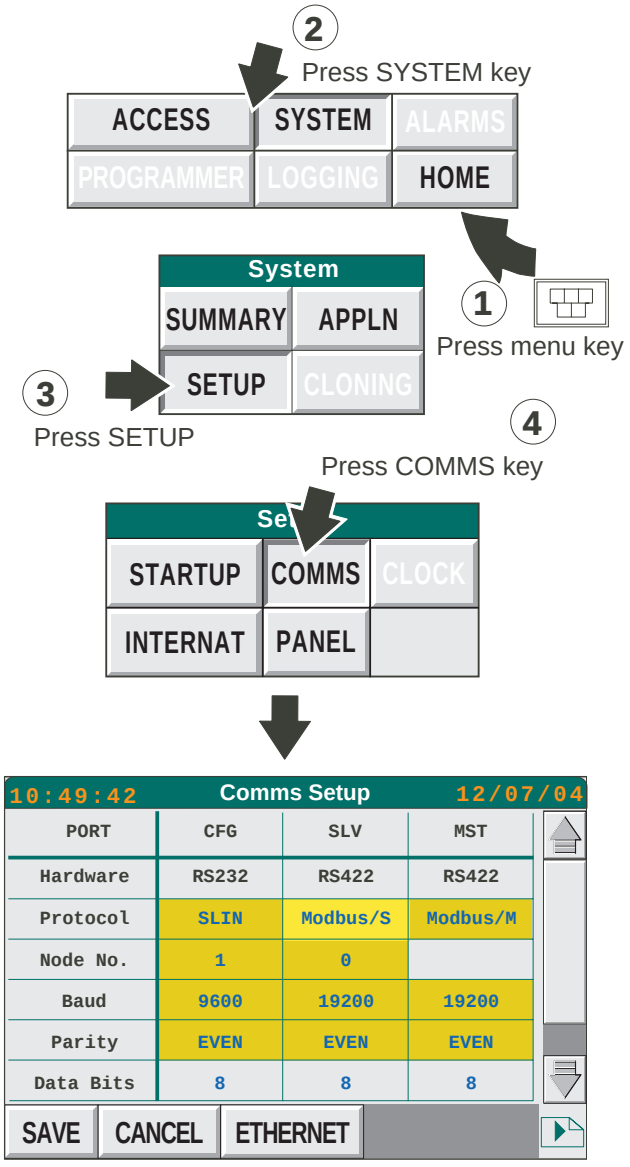


Figure A2.3a Visual Supervisor Comms Configuration Page

Notes:
1. Before operating the 'ETHERNET' button, operate the 'SAVE' button, or all changes made so far will be lost.
2. Before operating the COMMS button to return to the Comms setup page, operate the SAVE button, or all changes made in the Ethernet setup page will be lost.
3. On the small frame (1/4 VGA) version of the instrument, the three buttons 'SAVE', 'CANCEL' and 'ETHERNET' are hidden by a scroll bar. The Option key is used to toggle between the scroll bar and these buttons.
4. The user must have suitable access permission in order to edit the Ethernet setup.

A2.3 COMMS CONFIGURATION (Cont.)

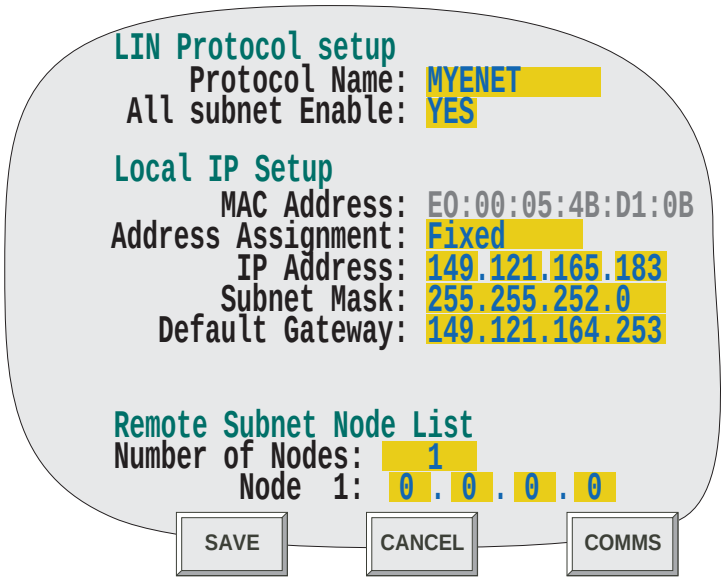


Figure A2.3b Ethernet setup items

Protocol name	Allows the user to enter a protocol name of up to 12 characters.
All Subnet enable	Select Yes or no.
MAC ADDRESS	This factory-set address is unique to the instrument and is non-editable.
Address Assignment	Select one of: Fixed, DHCP, BootP, DHCP+LL, BootP+LL, Link Local.
IP Address	May be edited only if ‘Fixed’ selected as Address assignment.
Subnet Mask	May be edited only if ‘Fixed’ selected as Address assignment.
Default Gateway	May be edited only if ‘Fixed’ selected as Address assignment.
Number of nodes	Enter 0 to 50. This is the number of nodes in the remote subnet.
Node N:	Allows the IP address of each remote node to be entered..

APPENDIX B: PC CONFIGURATION

B1 LOCAL IP SETUP

Caution

Many PCs already have IP addresses allocated because they are part of a company network. Changing the IP set-up in such a case will almost certainly stop the PC from communicating with other PCs and servers on the network.

The Process supervisors need to be allocated IP addresses that are compatible with any existing IP network. If in doubt the IT manager or System Administrator should be consulted.

Figure B1 illustrates the properties dialogue for configuring the PC IP settings.

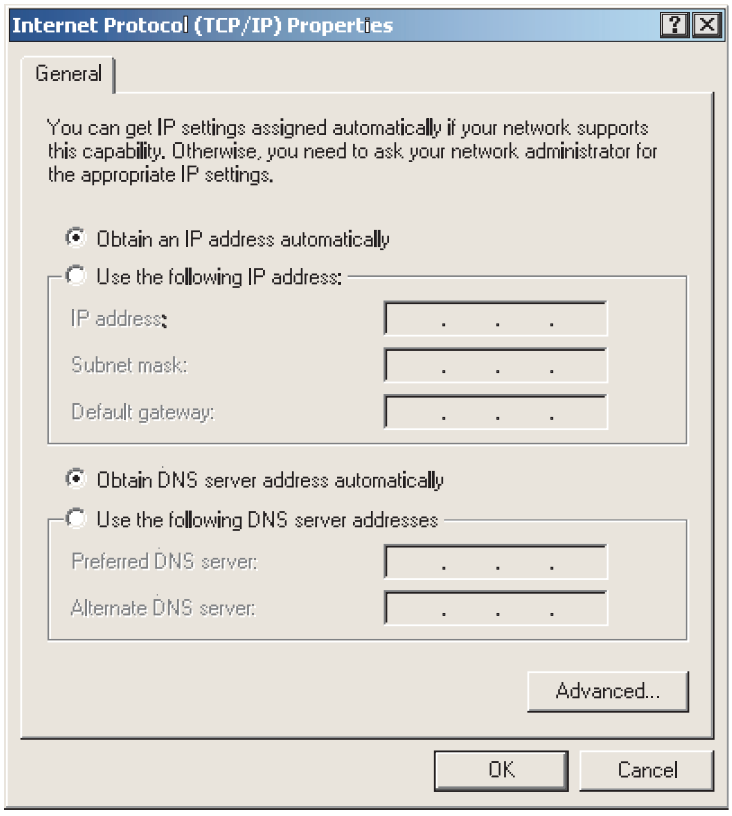

Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

Figure B1 TCP/IP Properties page

Clicking on the ‘Obtain an IP address automatically’ means that the PC will use DHCP, with a Link-Local fallback (Windows 98 and later). Selection of ‘Use the following address’ causes the greyed IP fields to become active, allowing the user to enter an IP address, subnet mask and default gateway, manually.

B2 ELIN SETUP

To configure as ELIN LINOPC port the LINOPC control panel applet (figure B2) is used. The dialogue box is similar to the ALIN equivalent, but has an extra field: Protocol Name, which defaults to 'NET'. The ELIN form does not have any card information because it uses the standard Ethernet card.

Note: The Cold Start Database is not supported by ELIN

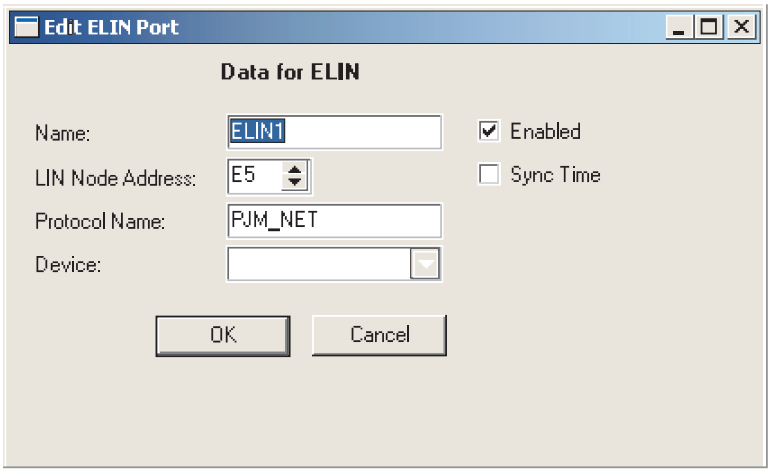


Figure B2 LINOPC page

B3 MULTI HOMED HOSTS

Multiple IP interfaces are supported by EurothermSuite versions 3.4 onwards. The way in which IP interfaces are identified by the host computer varies according to which Windows operating system (NT, 2000, XP) is running on it.

Some machines have two or more different IP network types attached to them, for example, Dialup, Ethernet copper, Wireless etc. Such machines are known as 'multihomed hosts'.

There are two ways of specifying the interface: 'Network interface = n' and a section LinDevice_n, described in B5 and B6, below.

Notes:
1. For single homed hosts, it is recommended that Network Interface be set to 0 (NetworkInterface = 0), and any {LINDevice_n] be omitted.
2. For mulitihomed hosts, the use of one or more [LINDevice_n] sections is recommended. This overrides any NetworkInterface variable setting.

B4 REMOTE SUBNET NODE LIST

If ELIN nodes on remote subnets are to be accessed, then the network.unh file must be edited at the PC, using a text editor such as Notepad. The file is to be found under …\Eurotherm\LINOPC. Entries need to be made in the "[PR]" section of the network.unh file. A list of the IP addresses of remote nodes to which it is desired to communicate needs to be entered.

When the necessary configuration is complete, EuroPRP.EXE must be restarted.

B5 THE NETWORK INTERFACE

NetworkInterface = n.

If n is set to zero, this allows the EurothermSuite software to make the best choice. This is the recommended 'safe and best' value for single-homed hosts.

Running IPCONFIG produces a list of interfaces, but for Windows 2000, and Windows NT operating systems, the interface numbers change dynamically, so the list rapidly becomes out-of-date.

B6 LINDEVICE_N SECTION

A LINDevice_n section defines, for an LINOPC port, which IP interface to use. "_n" refers to the device number in LINOPC control panel applet.

For any given ELIN Port (device) the network interface will be used, whose IP address, when ANDed with mask, matches the IP value specified in this section. The IP address for an interface can be found by typing IPConfig in a command box. If a Mask of 255.255.255.255 is used then the IP value specified in this section must be of the form A.B.C.D and must be an exact match of that for the required interface. If Mask is omitted it defaults to 255.255.255

e.g.
[LINDevice_1]
IPaddress=192.168.0.1
Mask=225.255.255.255

If a Mask of, say, 255.255.255.0 is specified in this section then the IP address must be of the form A.B.C.0 and the A.B.C must be a match of the IP for the required interface. This latter form is useful where an interface gets its address via DHCP and may not be fixed, although it will normally be within a fixed range. For example, the following would map onto any IP interface that is 192.168.x.x. If there is more than one such IP address then it will select one arbitrarily.

[LINDevice_1]
IPaddress=192.168.0.0
Mask=255.255.0.0

B7 THE NETWORK.UNH FILE

The network.unh file on the PC is common format with the Process Supervisor but uses only the fields described below. There is no tool to change the file, but it can be edited using a text editor such as Notepad. The file is to be found in …\Eurotherm\LINOPC.

[PR]
Example: IP=195.168.0.1
A list of IP addresses (outside the local subnet) with which it is desired to communicate. This section may be omitted if not required

[IP]
On multihomed hosts - defines which network interface is to be used. Default is '0'; NetworkInterface = 0

[LIN]
Controls whether LIN can communicate across subnets. Default is 'off'; AllSubnet = off

B8 EUROPRP.EXE

EuroPRP.EXE implements the PRP as described in section 3.1.2. Only one process is required for any number of NT Strategy Engines (NTSEs) on any one PC.

EuroPRP.EXE is started automatically by LINOPC.

For debug purposes, EuroPRP can be started in a console window. (If it is already running, End Task in ‘Task Manager’).

In the console window, change the directory to ...\Eurotherm\LINOPC

On the command line, type EuroPRP<space><hyphen>debug<space>0F

Note: Change 0F to 1F for more trace, or to 07 for less trace.

1. Start EuroPRP (it can be left running independently of LINOPC and Eurotherm Suite).
2. Start Explorer and an ELIN port should be visible.

If steps 1 and 2 are repeated on further PCs, each PC should be able to see the other PCs in Eurotherm Network Explorer. The debug window of EuroPRP should show messages of the form below for the other PC IP addresses. This indicates that the ELIN port resolution is functioning correctly. You should see a similar message for a Process Supervisor if one is connected to the ELIN.

```
PRP message received from 149.121.167.207     port 1264.....
    .....I_Am|LIN::0x0FFA#NTSE V4./2U000|149.121.167.207|1034|0|

Where 0x0FFA means Hex 0FFA
```

APPENDIX C: IP ADDRESSING

IP addressing can be an involved subject, and there is a great deal of reference material available on the internet if further detail is required. The information presented here provides a simple overview.

C1 IP ADDRESSING

An IP host has an IP address expressed in “dotted decimal” notation. For example 149.121.165.23. This actually represents a 4 byte (32-bit) number. For our previous example this is 95 79 A5 17 (hexadecimal).

Each IP address provides a range of Ports between 0 and 65535 (i.e. it is a 16-bit number).

Each service is accessed via a separate port, some of which are fixed (e.g. ftp uses port 20, http uses port 80)

C1.1 IP SUBNETS

IP networks are divided into subnets with the following characteristics:

1. A subnet is a range of addresses
2. A subnet range is defined by how many of the most significant IP address bits are common. In the example 149.121.X.X/16, the top 16 bits are common to all IP addresses in this subnet. All IP addresses in this subnet begin “149.121……”

A subnet can also be defined in terms of the subnet mask

1. A Subnet mask is expressed in dotted decimal notation
2. All common address bits are set to ‘1’ in subnet mask
   Example: “/16” = “255.255.0.0”

C1.2 IP SUBNETS / CROSS SUBNET WORKING

1. IP addresses on a single subnet are considered local to one another
2. Broadcasts reach only local IP addresses
3. IP addresses outside this subnet are reached through a default gateway.

C1.3 CLASS-BASED ADDRESSING

Some products (e.g. the Process Supervisor) use a class-based addressing mechanism that pre-dates the current ‘Classless Inter-Domain Routing’ (CIDR) mechanism.

The class-based system divides the internet address space into a number of Classes, as shown in table C1.3. For this type of addressing, the subnet masks are at Byte boundaries, as opposed to bit boundaries. Thus, a subnet mask for a class C address such as 255.255.252.0 is converted to 255.255.255.0.

In order to avoid misinterpretation of the information in the network.unh file, valid pre-CIDR subnet masks must be used.

Class	Address		Example	Default subnet mask
A	0	network: 7 bits; host: 24 bits	90.1.2.3	255.0.0.0
B	10	network: 14 bits; host: 16bits	128.0.1.2	255.255.0.0
C	110	network: 21 bits; host: 8 bits	192.0.0.1	255.255.255.0
D	1110	multicast group ID: 28 bits	224.0.0.1	None

Table C1.3 Class-based subnet masks

APPENDIX D: IP ADDRESS ALLOCATION METHODS

D1 MANUAL IP ADDRESS CONFIGURATION

This means that the user must explicitly set the value of IP address and subnet mask. If cross-subnet working is required, the value of default gateway must also be set.

Note: The process supervisor IP address must be set manually.

D2 DHCP

This is a method whereby the IP host asks a DHCP server to provide it with an IP address, subnet mask and default gateway. Typically this happens at start-up, but can be repeated during operation. DHCP includes the concept of 'leases' (i.e. the assigned values will expire). The simpler BootP protocol is used in lieu of DHCP by some instruments. BootP requires the DHCP server to be present when it starts-up, as there is no option to repeat the request.

In either case, a DHCP server is required that can be configured to respond correctly to the request. The configuration depends on the network policy of the local IT department.

D3 LINK-LOCAL

Link-Local was originally specified as a fallback to DHCP, but is now used as a fallback to DHCP or BootP, or it can be used on its own as the only IP address allocation method. Link-Local always assigns an IP address in the range 169.254.X.Y. This address range is reserved for use by Link-Local and is explicitly defined as private and non-routable. For this reason there is no concept of a default gateway with Link-Local. The subnet mask with Link-Local is always 255.255.0.0.

The Link-Local algorithm ensures that all hosts on a network choose a unique IP address from the Link-Local range.

Link-Local is supported by ELIN instruments. It is also supported by Microsoft Windows 98 and onwards, as a fallback from DHCP.

APPENDIX E: NETWORK.UNH FILE

The following is a sample network.unh file with comments to describe the various elements.

```
[PR]
#A list of IP addresses (outside the local subnet) with which it is desired to communicate. This section may be omitted
#if not required
IP=192.168.0.1

[IP]
#On multihomed hosts - defines which network interface is to be used
#Default is “0” - system makes “best choice”; >0 = user choice
NetworkInterface = 0

#The following three lines are used on an instrument which requires a fixed IP configuration
IPaddress=192.168.0.1
Subnet=255.255.255.0
DefaultGateway=192.168.0.8

#The following are used on an instrument to control the allocation of server allocated or dynamically allocated IP
#configurations. They are used instead of the fixed IP configuration lines (above). By default DHCP with
#fallback to LinkLocal is enabled. NOTE: some instruments that do not support DHCP will use BootP in lieu of
#DHCP.
DHCP=on
LinkLocal=on
BootP=off
BootPtimeout=1

[LIN]
#Controls whether LIN can communicate across subnets - default is “off”
AllSubnet=off

#NOTE: The remaining parts of the “[LIN]” section are required on instruments only

#Defines the LIN protocol subname - default is “NET”
ProtocolName=NET

#On instruments which offer multiple LIN types (e.g. ALIN or ELIN) - determines whether ELIN is used. Default is
#“off”
Elin=off
```

APPENDIX F: GLOSSARY

BootP	Bootstrap Protocol. This is intended to allow a unit (as it starts up) to acquire its IP address, subnet mask and default gateway, along with instructions on the code that it should load and run.
Default gateway	The IP host to which communications should be directed when attempting to communicate with IP addresses in a different subnet.
DHCP	Dynamic Host Configuration Protocol. A superset of the IP parameter acquisition part of BootP.
ELIN	LIN protocol over Ethernet using IP.
Ethernet	A physical and electrical standard for the low level transfer of computer data packets.
IP	Internet Protocol. A communications protocol intended for use with wide area networks. Now very much the standard for computer communications.
IP host	A physical piece of equipment which can communicate using IP
LIN Node	An entity which can communicate using LIN Protocol. Traditionally this has been a discrete physical entity, although with ELIN it is now possible to run more than one virtual LIN Node on a single PC.
LIN Node Number	A number which uniquely identifies a LIN Node. The number is 8-bits, expressed in hexadecimal notation. All zeros and all ones values are excluded, so valid LIN Node Numbers are from hex 01 to hex FE
LIN Network	A collection of LIN Nodes which are capable of communicating with each other on demand.
Link-Local	A method by which an IP host can derive a local network-unique IP address, by negotiating with the other IP hosts on the same network. Originally conceived as a fallback from DHCP, it is now also permitted to operate as a fallback to BootP. Link-Local can also be used in its own right as the primary method of IP address allocation.
Multihomed host	An IP host which has more than one network interface (and hence more than one IP address).
NAT	Network Address Translation – A method (usually employed at a router and/or firewall) where the identity of the source or destination of a data packet (expressed as IP address + Port number) is translated to a different identity packet (expressed as a different IP address and/or Port number). One example where this may be used is where an organisation presents a single IP address to the public internet, but has multiple hosts on its internal private network – packets originating from hosts on the private network have their identities changed through NAT as they leave onto the public internet; and the reverse translation is applied as replies as received back.
Network interface	The physical connection provided by an IP host to allow it to connect to the network.
Subnet	A local network of IP hosts directly connected to one other and able to communicate directly with one other without the use of a gateway.

INDEX

A

ALIN/ELIN LEDs 17

B

BootP 28

C

Cabling 3
CIDR 25
Class based addressing 25
ClearCnt 10
Comms configuration (Visual supervisor) 19
Compatibility 3
Cross subnet working 8

D

Default gateway 28
DHCP 26, 28
Diagnostic block types 9

E

ELIN 28
  Connection
    Process Supervisor 14
    Visual Supervisor 18
  LEDs 17
  Setup 22
    Page 16
ELINDIAG block 9
EMAPDIAG block 11
Ethernet 28
EuroPRP.exe file 24

F

Firewall configuration 8

G

Glossary 28

I

IP 23, 27, 28
  Address Allocation Methods 26
  Addressing 25
  Host 28
  Subnets 25
    Cross subnet working 25
Isolated ELIN 4
  With defined addressing 5

L

LastErr 9
LastI_Am 11
LIN 23, 27
  Network 28
  Node 28
    Number 4, 28
LINDevice_n section 23
Link-Local 26, 28
LLCport 9
Local IP setup 21

M

MACport 9
MACstate 9
MACtype 9
Manual IP Address Configuration 26
Mapping nodes to IP address and Port number 6
Multi-homed hosts 22, 28

N

NAT 10, 28
Network interface 28
Network interface file 23
Network.unh File 27
Network.unh file 23
NextNode 10
NodeNext 11
NodePrev 11
NodeStat 11
NoImmRsp 10
Non-Isolated ELIN 5

P

PC Configuration 21
Port numbers 8
PR 23, 27
PrevNode 10, 11
PrimIP 9
PrimPort 9
Procesor 9
Prot_S 12
Protocol names 7
PRPDIAG Block 12

R

RemEntry 9
Remote subnet node list 22
Remstate 10
RxCount 10
RxReq 10
RxRspBsy 10
RxRspErr 10
RxRspOk 10
RxUnknown 10

S

ScndIP 9
ScndPort 9
ScWeight 10
SegN_map 11
Subnet 28

T

Terminal configurator 15
Terminators 3
ThisIP 9
ThisNode 9, 11
ThisPort 9
TimeNow 11
TxCount 10
TxImmRsp 10
txReject 10
TxTimOut 10

V

Visual supervisor 18

Inter-Company sales and service locations

Australia
Eurotherm Pty. Limited.
Unit 10.
40 Brookhollow Avenue,
Baulkham Hills,
NSW 2153
Telephone: 61 2 9634 8444
Fax: 61 2 9634 8555
e-mail: eurotherm@eurotherm.com.au
http://www.eurotherm.com.au

Austria
Eurotherm GmbH
Geiereckstraße 18/1,
A1110 Wien,
Telephone: 43 1 798 76 01
Fax: 43 1 798 76 05
e-mail:eurotherm@eurotherm.at
http://www.eurotherm.at

Belgium and Luxemburg
Eurotherm S.A./N.V.
Rue du Val-Notre-Dame 384,
4520 Moha (Huy)
Belgium
Telephone: 32 (0) 85 274080
Fax: 32 (0) 85 274081
e-mail: sales@eurotherm-belgium.be
http://www.eurotherm.nl

Denmark
Eurotherm Danmark A/S
Finsensvej 86,
DK 2000 Fredriksberg,
Telephone: +45 (38) 871622
Fax: +45 (38) 872124
e-mail: salesdk@eurotherm.se

Finland
Eurotherm Finland,
Aurakatu 12A,
FIN-20100 Turku
Telephone: 358 2 25 06 030
Fax: 358 2 25 03 201

France
Eurotherm Automation Division Chessell
Parc d'Affaires,
6, Chemin des Joncs,
BP55
F - 69574 Dardilly, CEDEX
Telephone: 33 0 4 78 66 55 20
Fax: 33 0 4 78 66 55 35
e-mail: chessell@automation.eurotherm.co.uk
http://www.eurotherm.tm.fr

Germany
Eurotherm Deutschland GmbH
Ottostraße 1,
65549 Limburg
Tel: +49 (0) 64 31/2 98 - 0
Fax: +49 (0) 64 31/2 98 - 1 19
e-mail:info@regler.eurotherm.co.uk
http://www.eurotherm-deutschland.de

Great Britain
Eurotherm Limited,
Faraday Close,
Worthing,
West Sussex BN13 3PL
Telephone: +44 (0)1903 695888
Fax: +44 (0)1903 695666
e-mail:Sales@recorders.eurotherm.co.uk
or: Support@recorders.eurotherm.co.uk
http://www.eurotherm.co.uk

Hong Kong
Eurotherm Limited,
Unit D, 18/F Gee Chang Hong Centre,
65, Wong Chuk Hang Road,
Aberdeen.
Telephone: 852 2873 3826
Fax: 852 2870 0148
e-mail:eurotherm@eurotherm.com.hk

India
Eurotherm DEL India Limited,
152, Developed Plots Estate,
Perungudi,
Chennai 600 096,
Telephone: 91 44 4961129
Fax: 91 44 4961831
e-mail: info@eurothermdel.com
http://www.eurothermdel.com

Italy
Eurotherm SpA,
Via XXIV Maggio,
I-22070 Guanzate,
Como.
Telephone: 39 031 975111
Fax: 39 031 977512
e-mail:info@eurotherm.it
http://www.eurotherm.it

Korea
Eurotherm Korea Limited,
J- Building
402-3
Poongnab-Dong,
Songpa-Ku
Seoul, 138-040
Telephone: 82 2 478 8507
Fax: 82 2 488 8508

Netherlands
Eurotherm BV,
Genielaan 4,
2404CH Alphen aan den Rijn,
The Netherlands
Telephone: 31 172 411 752
Fax: 31 172 417 260
e-mail: Sales@eurotherm.nl
http://www.eurotherm.nl

Norway
Eurotherm A/S,
Vollsveien 13D
1366 Lysaker,
Postboks 227
NO-1326 Lysaker
Norway,
Telephone: 47 67 592170
Fax: 47 67 118301
http://www.eurotherm.no

Spain
Eurotherm España SA,
Pol. Ind. De Alcobendas,
Calle de la Granja 74,
28108 Alcobendas,
Madrid.
Telephone: 34 91 661 60 01
Fax: 34 91 661 90 93
http://www.eurotherm.es

Sweden
Eurotherm AB,
Lundavägen 143,
S-21224 Malmö.
Telephone: 46 40 38 45 00
Fax: 46 40 38 45 45
e-mail:info@eurotherm.se
http://www.eurotherm.se

Switzerland
Eurotherm Produkte (Schweiz) AG,
Schwerzistraße, 20,
CH-8807 Freienbach.
Telephone: 41 55 415 44 00
Fax: 41 55 415 44 15
e-mail:epsag@eurotherm.ch
http://www.eurotherm.ch

United States of America
Eurotherm Recorders Inc.
741-F Miller Drive
Leesburg
VA 20175-8993
Telephone: 1 703 669 1342
Fax: 1 703 669 1307
e-mail (Sales): sales@chessell.com
e-mail (Technical): support@chessell.com
http://www.chessell.com

invensys
EUROTHERM

EUROTHERM LIMITED
Faraday Close, Durrington, Worthing, West Sussex, BN13 3PL
Telephone: 01903 695888 Facsimile: 01903 695666
e-mail: info@eurotherm.co.uk
Website: http://www.eurotherm.co.uk

Specification subject to change without notice. ©Eurotherm Limited.